FLOOD INSURANCE STUDY

CITY OF SUGAR LAND, TEXAS
FORT BEND COUNTY

OCTOBER 16, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 480234

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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PUBLISHED SEPARATELY:

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FLOOD INSURANCE STUDY
CITY OF SUGAR LAND, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Sugar Land, Fort Bend County, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses in this study represent a revision of the original analyses prepared by Espey, Huston and Associates, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. H-4569. The work for the original study was completed in April 1980.

The updated hydrologic and hydraulic analyses for the Brazos River were prepared by Espey, Huston and Associates, Inc.; this work was completed in May 1985. A revision was also prepared by Dewberry and Davis to reflect updated corporate limits for Sugar Land; this work was completed in June 1986.

1.3 Coordination

An initial Consultation and Coordination Officer's (CCO) meeting was held on May 12, 1978, to determine the streams to be studied by detailed methods. This meeting was attended by representatives of FEMA; Espey, Huston and Associates, Inc. (the study contractor), the U. S. Geological Survey (USGS); Fort Bend County Engineers; and other state and local officials.

On April 9, 1981, a final CCO meeting was held with representatives of FEMA, local officials, and the study contractor to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Sugar Land, Fort Bend County, Texas. Several unincorporated areas of Fort Bend County and Fort Bend County Levee Improvement District (L.I.D.) No. 2, which lie within the corporate limits of Sugar Land, are not included in this study. The area of study is shown on the Vicinity Map (Figure 1).

Two flooding sources were studied by detailed methods: Oyster Creek, for its entire length within the community; and the Brazos River, for its flooding affecting the community. A sheet flow area along the Brazos River was also studied by detailed methods. This study was revised to incorporate an updated hydrologic and hydraulic analyses for the Brazos River and recent annexations of land by the community. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

Alkire Lake, Brooks Lake, Clear Lake, Eldridge Lake, Horseshoe Lake, North Lake Sugar Creek, South Lake Sugar Creek, North Pecan Lake, Lake Jane Long, Cleveland Lake, Unnamed Lake, Brooks Lake Diversion Channel, Ditch H, and Venetian Lake were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the City of Sugar Land.

2.2 Community Description

The City of Sugar Land is located in the northeast portion of Fort Bend County, approximately 10 miles northeast of Richmond. It is bordered by the City of Houston to the north, the City of Stafford and First Colony L.I.D. to the east, and the unincorporated areas of Fort Bend County to the south and west. The population of Sugar Land was 8,800 in 1980 (Reference 1).

The pressure for residential development within the community is great due to its location in the northeastern portion of the county and near the southwestern boundary of Houston and Harris County. Passing through the southwestern portion of the city, development can be found along both sides of Oyster Creek.

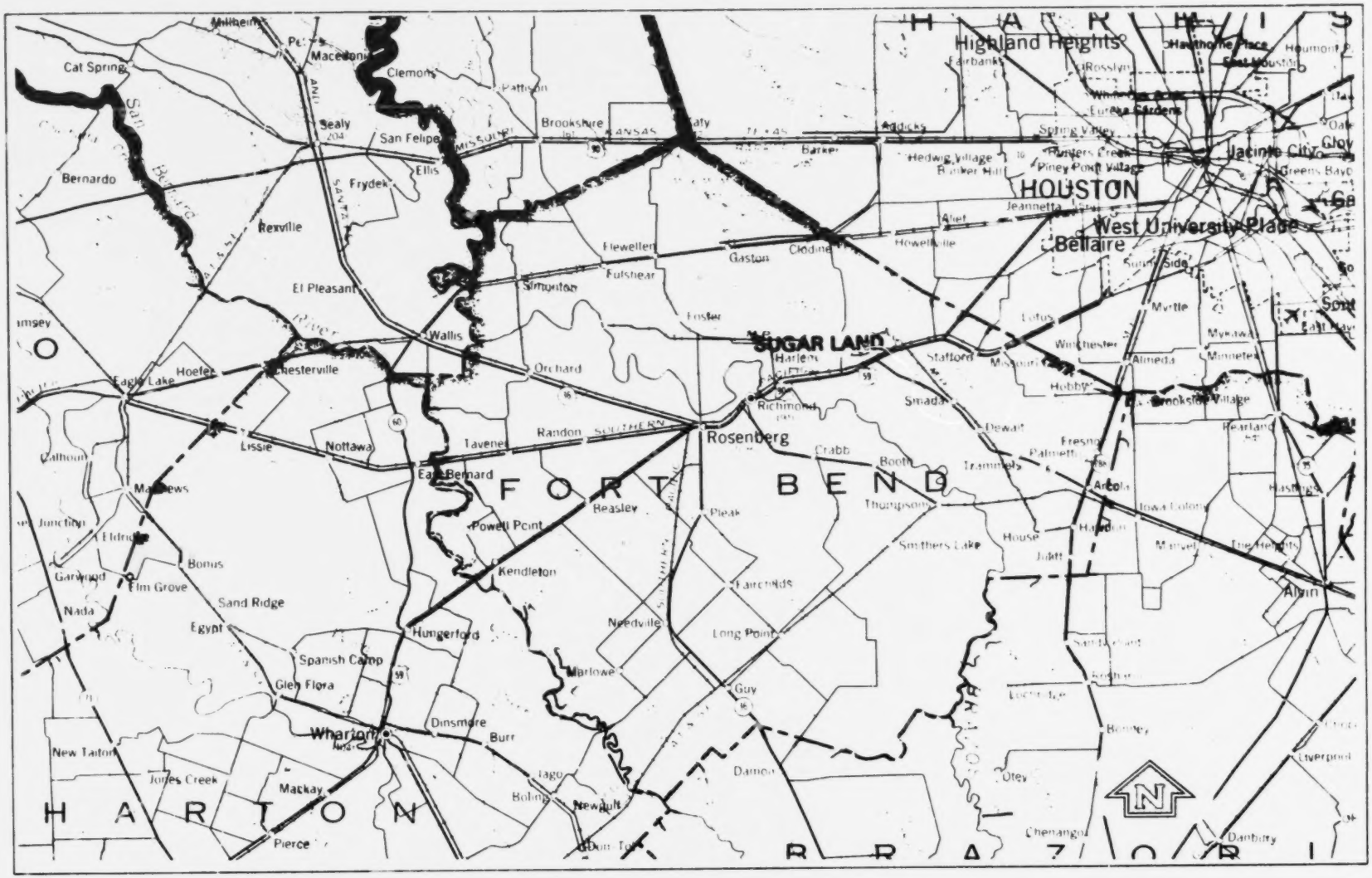


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SUGAR LAND, TX

(FORT BEND CO.)

APPROXIMATE SCALE

8 0 8 16 24 MILES

VICINITY MAP

Temperatures within the community range from 92 degrees Fahrenheit (°F) to 73°F in the summer and from 65°F to 45°F in the winter. Normal annual precipitation is 45 inches. The rainfall occurs during intense local thunderstorms of short duration, general storms extending over periods of several days, and rainfalls associated with hurricanes and other tropical storms.

The topography of Sugar Land is relatively flat except for changes in elevations along the streams. The soil is predominantly impervious clay. The major land use is for residential and commercial purposes.

2.3 Principal Flood Problems

There are no reports on historical flooding in Sugar Land other than the 1913 flood of the Brazos River.

2.4 Flood Protection Measures

Levees were built in the 1920's to protect Sugar Land from the Brazos River. FEMA requires a minimum of 3 feet freeboard to be considered a safe flood protection structure. The levees in Fort Bend County meet the FEMA requirement.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The 100-year flows for Oyster Creek were determined using a regionalized methodology developed by the USGS (Reference 2). Flows were adjusted using SCS Technical Release No. 55 channel slope adjustment factors to account for the mild Oyster Creek slope (Reference 3). Flow diversions from Oyster Creek were determined from available information. The 500-year discharges were derived by extrapolation of lower frequency discharges.

The 10-, 50-, 100-, and 500-year discharges for the Brazos River were determined using a frequency curve developed from data collected at the Richmond, Texas, gaging station in accordance with Bulletin 17B (Reference 4). The computed flows were then adjusted for the specific frequencies using the COE HEC-1 flood hydrograph computer program (Reference 5). The methodologies used in the 100-year determination are presented in a 1984 report by the study contractor (Reference 6).

A summary of the drainage area-peak discharge relationships for Oyster Creek and the Brazos River is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
OYSTER CREEK					
Approximately 0.2 mile upstream of Lester Road	33.3	*	*	1,800	2,100
At Oyster Creek Drive	26.2	*	*	2,282	3,130
BRAZOS RIVER					
Approximately 5.6 miles upstream of Atchison, Topeka, and Santa Fe Railway	21,380[1]	101,000	157,000	111,000	24[illegible],000

[1]Area below Possum Kingdom Reservoir; area above reservoir determined non-contributary to 100-year flood.

*Not computed

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for the streams studied by detailed methods were obtained by third order leveling and interpretation of USGS topographic maps at a scale of 1:24,000 with a contour interval of 5 feet (Reference 7). All bridges and culverts were field surveyed in order to compute the significant backwater effects of these structures.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 8). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. The starting water-surface elevations for the streams studied by detailed methods were obtained by slope/area computations.

Roughness coefficients (Manning's "n") used in the hydraulic computations were estimated on the basis of field observations. The channel "n" value for Oyster Creek was 0.040, and the overbank "n" value was 0.060. For the Brazos River, the channel "n" values ranged from 0.023 to 0.025, and the overbank "n" values ranged from 0.012 to 0.060.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides maps designed to assist communities in developing floodplain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (Reference 7).

For the flooding sources studied by approximate methods, only the 100-year floodplain boundary has been shown. The boundary of the 100-year flood was delineated using the previous Flood Insurance Study for the City of Sugar Land and topographic maps (References 9 and 7).

The 100- and 500-year floodplain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the floodplain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Oyster Creek								
A	29.91	176	1,327	1.0	72.55	72.55	72.55	0.0
B	30.86	281	2,443	0.9	73.45	73.45	73.45	0.0

[1]Miles above Fort Bend-Brazoria county boundary

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SUGAR LAND, TX

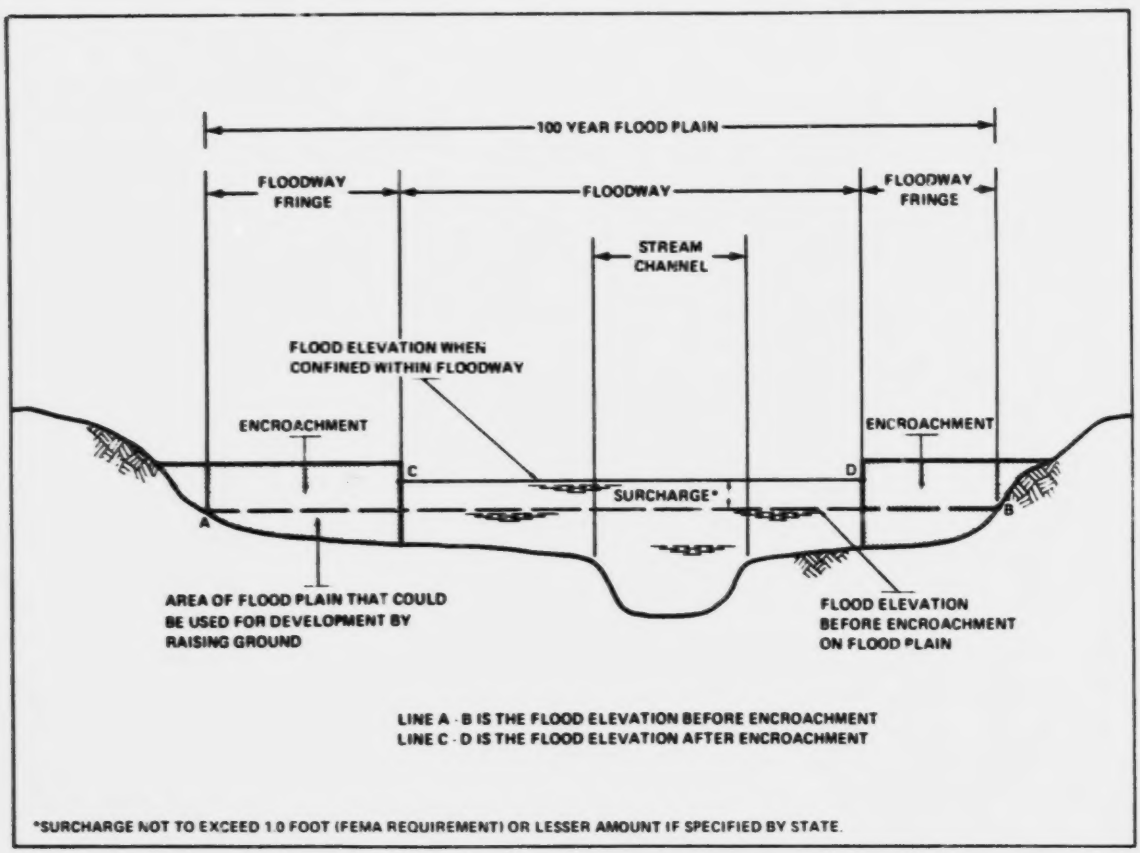
(FORT BEND CO.)

FLOODWAY DATA

OYSTER CREEK

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC

Figure 2

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail in the City of Sugar Land.

5.1 Reach Determinations

Reaches are defined as sections of floodplain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following tabulation for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the City of Sugar Land are shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Brazos River							
Reach 1	15,20,25	-3.7	-0.7	+2.0	035	A7	Varies
Sheet Flow Area	15	Shallow Flooding Area - Average Depth 1 Foot				A0	--
Oyster Creek							
Reach 1	05,15,20	-2.0[4]	*	+1.9	020	A4	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map
[4]Computed using approximate 10-year flood elevation
*Not computed

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SUGAR LAND, TX

(FORT BEND CO.)

FLOOD INSURANCE ZONE DATA

BRAZOS RIVER - OYSTER CREEK

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.

Zone AO: Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; depths are shown but no FHFs are determined.

Zones A4 and A7: Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.

Zone B: Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Sugar Land is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

Flood Insurance Studies for Fort Bend County and Certain Political Districts, Fort Bend L.I.D. No. 2, and the Cities of Houston and Stafford have been completed (References 10, 11, 12, and 13). The results of this study are in agreement with the results of those studies.

Due to its more up-to-date nature, this study supersedes the previous Flood Insurance Study for the City of Sugar Land (Reference 9).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Region VI Office, Federal Center, Denton, Texas 76201.

8.0 BIBLIOGRAPHY AND REFERENCES

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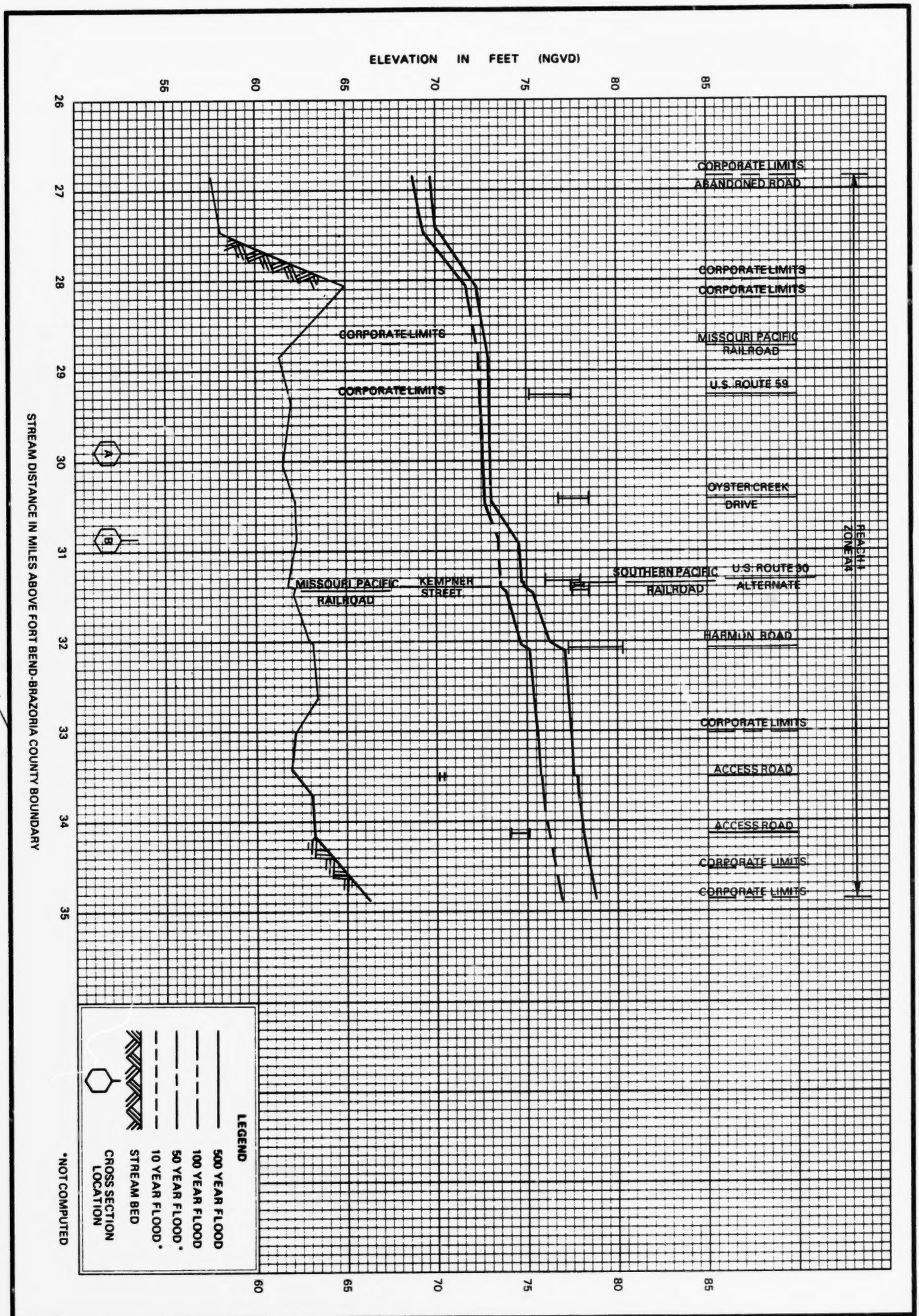
12. Federal Emergency Management Agency, Flood Insurance Study, City of Houston, Fort Bend, Harris, and Montgomery Counties, Texas, Washington, D. C., September 27, 1985.

13. Federal Emergency Management Agency, Flood Insurance Study, City of Stafford, Fort Bend County, Texas, Washington, D. C., March 1, 1982.



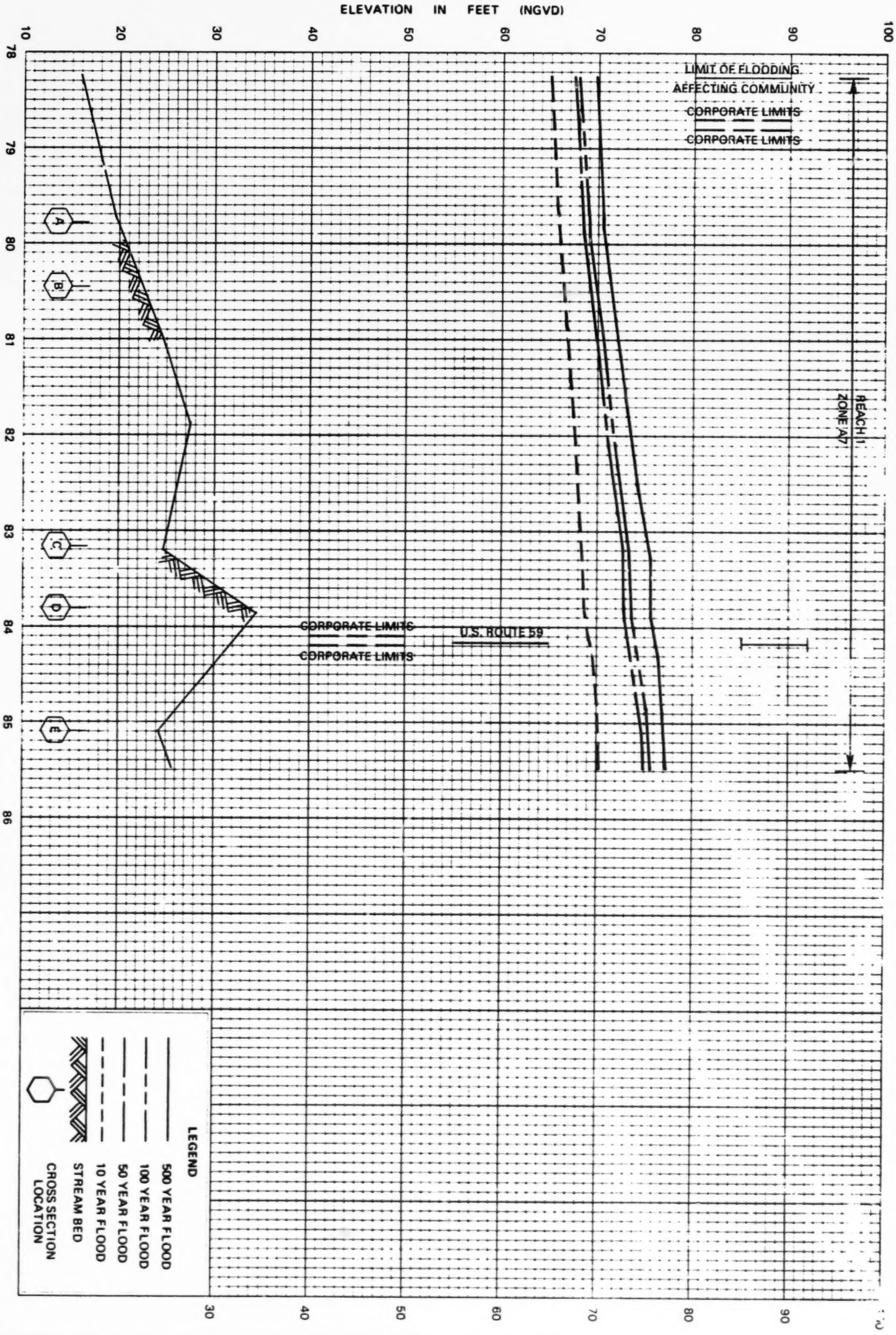
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SUGAR LAND, TX
(FORT BEND CO.)

FLOOD PROFILES

OYSTER CREEK

01P



FEDERAL EMERGENCY MANAGEMENT AGE Y

CITY OF SUGAR LAND, TX
(FORT BEND CO.)

FLOOD PROFILES

BRAZOS RIVER

02P